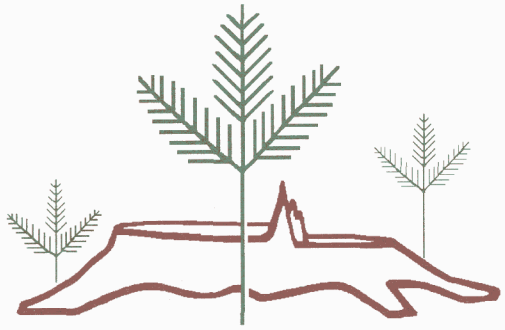

Woodland Owner Notes

Reforestation of North Carolina's Pines

The Southern pines may reproduce themselves more successfully in most cases when special efforts are made to encourage regeneration. But first, owners should allow time to begin planning reforestation well in advance of the harvest cut. Such problems as understory vegetation control, site or seedbed preparation, and source of seed or seedlings must all be examined. Either artificial regeneration that involves planting seed or seedlings, or natural regeneration which relies on existing seedlings or seeds may be used. The practice of "letting nature take its course" often results in poor stands of low quality hardwood.

If artificial or natural regeneration is to be effective, landowners should follow appropriate guidelines. For specific recommendations on a particular tract, contact a N.C. Forest Service Forester, consultant forester or industrial landowner assistance forester.

Preharvest Treatments

Preharvest treatments lower the cost of reforestation by reducing competition from cull hardwoods and other weeds. This results in a greater rate of early growth and survival of regenerated stands. The end result of preharvest treatment is to reduce the need for heavy mechanical site preparation after the regeneration cut. The two most common preharvest treatments which may be used alone or in combination are:

Prescribed Burning. Fire applied under proper fuel moisture and weather conditions is a cost-effective method to reduce weed competition. Fire is particularly effective in killing small diameter, thin-barked hardwood species such as maple and sweetgum. Burning excess fuel in pine stands by using prescribed burning also reduces the risk of wildfire.

Prescribed burning may be done in loblolly, shortleaf, longleaf, and pond pine stands. These species have a thick well-insulated bark when over 4 inches in diameter and 20 feet in height. Eastern white pine is thin-barked and will not tolerate prescribed burning. It may be necessary, depending on density of weed competition and amount of fuel, to treat with more than one burn.

Burning may begin 6 to 8 years prior to the final timber harvest and be repeated at 2 to 3 year intervals with the final burn done within 2 years of the harvest.

Timber Stand Improvement (TSI). Prior to the final harvest, crews should kill trees of inferior species, poor form or trees infected with insects and disease. TSI can reduce undesirable seed and sprout sources and eliminates competition when it is used in certain stands. TSI is often carried out in stands

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where all hardwoods exceed 4 inches in diameter or in stands where prescribed burning is not recommended, such as in the management of white pine which is not fire resistant.

TSI may be done manually, mechanically or with herbicides. Trees killed may often be used for firewood, posts or other wood products.

Harvesting and Logging

In Southern pine regeneration, the harvest is much more than just a logging operation. Loggers must take extreme care to avoid logging with heavy equipment during periods of soil saturation. Poor logging practices can be severe and so irreversible that they cause loss in soil productivity and damage residual trees which may provide a seed source. A well-written timber sale contract is essential. See Woodland Owner Note 10, *Timber Sale Agreements*.

Two removal cuts are often required for successful natural regeneration. The first cut removes the bulk of the timber volume, but leaves scattered trees of good form and quality as seed producers. After new seedlings are established, the second cut removes the seed-producing trees scattered over the site. Exceptions sometimes occur when the contractor makes a single harvest cut at the time of, or shortly following, seedfall. Another exception is found when enough young natural seedlings are already growing prior to the harvest cut. A more detailed description of natural regeneration methods follows in another section.

A single clear-cut harvest normally precedes artificial regeneration (planting seeds or seedlings). Depending on the amount of non-merchantable timber, brush, and debris left after the clear-cut, the stand may require one or more site preparation practices. An ideal clear-cut is one that removes all standing timber, a case often found when a whole tree chipper is used.

Site Preparation

Prior to planting, the site may require removing competition from weeds and hardwoods. Site preparation may not be necessary if preharvest treatments and the logging operation have left a sufficiently clean site.

Site preparation methods will vary with soil type, soil moisture, geographic region, and with the type and density of a site's competition. Alternatives for site preparation include fire, herbicide, manual labor, and heavy equipment.

Consult a professional forester to select the preparation method appropriate for the site and to help locate contractors.

Natural Regeneration Methods

Longleaf, loblolly, shortleaf, and Virginia pine seed should contact mineral soil for successful germination and early survival. If a poor seed crop is expected or if additional soil scarification is required, site preparation will be necessary for successful natural regeneration of these species. Eastern white pine does not require bare soil to germinate, but a heavy duff layer may reduce its survival since those seedling roots just beginning to emerge must reach mineral soil to assure adequate nutrients and water.

Seed tree is the most commonly used system recommended for the dependable seeders, such as loblolly, shortleaf, and Virginia pine. Because Virginia pine is shallow rooted, it is susceptible to windthrow, which may limit seed tree regeneration to areas of low wind exposure. To provide adequate seed, specialists recommend the following number of evenly distributed seed trees per acre (Table 1).

Table 1. Minimum number of seed trees per acre.

DBH	Loblolly	Shortleaf	Virginia
10	12	20	6
12	9	14	5
14	6	12	4
16+	4	12	4

Not only is selecting the seed trees critical, but so is timing the regeneration cut. Foresters should locate seed trees that are well spaced, vigorous, sound, and of good form and quality. To discourage accidental cutting, seed trees should be clearly marked prior to the regeneration cut.

Timing of the regeneration cut is critical. The regeneration cut should be completed early enough in a good seed year so that any site preparation can be done prior to seedfall from the residual seed trees which occurs in late summer through November. Good seed crops occur every 3 to 5 years and can be predicted a year in advance since it takes 2 years for cones to mature.

Shelterwood is most easily described as a heavy seed tree. Foresters leave more seed trees per acre to insure an abundant seed source (Table 2). For white pine, the protection that shelter trees provides can increase the survival of seedlings. Shelterwood is preferred for non-prolific seed producers, such as longleaf pine, but may be used successfully with all Southern pine species. One distinct advantage of the shelterwood system over the seed tree system is that shelterwood increases competition control due to shading by the sheltering trees.

Table 2. Number of shelterwood trees commonly recommended per acre.

DBH	Number of Shelterwood Trees
12	38-57
14	30-45
16+	21-29

Strip clearcuts involve the harvest of timber in strips 200 to 300 feet wide. Strips should be perpendicular to the direction of prevailing winds in order for seeds from neighboring uncut woodland to become evenly distributed. Only one cut is required in the regeneration area to allow for this kind of seed distribution.

Seed-in-place consists of clearcutting a stand after seed fall, but before the dispersed seeds can germinate. Winter logging done in a good seed year may accomplish seed-in-place regeneration.

Seedling-in-place entails clearcutting a stand in the year following a good seed year after seed has germinated. By waiting until seed germinates, a landowner can better determine the actual number of seedlings present. This method is most successful in poorly stocked stands with little or no understory competition.

Evaluating Natural Regeneration

Natural regeneration is successful if 300 to 700 well-distributed seedlings per acre are present and free to grow after three (3) growing seasons. If all guidelines are followed, success occurs often to the point of excess. Thousands of seedlings per acre are common, a problem that can create overstocking at an early age. Seed and shelterwood trees may be removed after successful regeneration is assured.

If stocking results in more than 1,500 seedlings per acre, pre-commercial thinning may be needed in years 3 to 5. Manual, chemical or mechanical methods may be used depending on the situation.

If natural regeneration fails, all is not lost. Removal of seed trees and shelterwood trees followed by tree planting may be all that is required, particularly if the effects of preharvest treatment and site preparation have reduced competition sufficiently. Otherwise, the landowner would need to establish a new stand through site preparation and seed or seedling planting.

Artificial Regeneration

Artificial regeneration has several advantages over natural regeneration: better control over tree spacing; more control over species; the opportunity to plant genetically improved seed or seedlings; and a lower risk of failure. The costs of artificial regeneration are generally higher than natural methods.

Several factors must be considered for successful Southern pine plantations:

Species selection. Landowners should select a species that is well adapted to the geographic region and to the soil type of the chosen site (Table 3). It also should be acceptable on the local timber market.

Table 3. Generally recommended tree species by geographical region.

Coastal Plain	Piedmont	Mountains
Longleaf Pine	Virginia Pine	White Pine
Loblolly Pine	Shortleaf Pine	Virginia Pine
Pond Pine	Loblolly Pine	

Spacing Recommendations. Tree spacing will vary with soil quality, desired rotation length, and species (Table 4). Local markets will also affect spacing recommendations; for example, in areas with poor pulpwood markets, a wider initial spacing should be used so that trees removed in early thinning will be sawtimber rather than pulpwood sized.

Table 4. Generally recommended initial tree spacings.

Species	Min	Max	Trees/ac
Loblolly Pine	10 x 10	6 x 9	435-800
Pond Pine	10 x 10	6 x 9	435-800
Longleaf Pine	7 x 10	6 x 8	622-870
Shortleaf Pine	8 x 12	6 x 10	450-726
Virginia Pine	8 x 8	6 x 6	675-1225
White Pine	12 x 12	7 x 10	300-622

Planting Seedlings. A plantation may be established by hand or by machine planting the seedlings. Contract crews are available throughout North Carolina, or landowners may wish to plant their own timberland. Special planting bars (dibbles), mattocks or machines used to plant seedlings are available through forestry equipment suppliers.

Proper storage and field handling of seedlings is essential. They may be stored up to 2 weeks in a cool, damp (but not wet) location and up to 10 weeks in a cold storage, but should be planted as soon as possible for best survival. Any seedlings which are dry, brittle, moldy or otherwise damaged should be discarded. In the field, care must be taken not to expose roots to wind and sun. A canvas bag or a bucket filled with a moist medium is best for field storage. Commercial root dips are also available for this purpose.

Seedling size will affect early survival and growth. Root collar diameter (at ground level) should be no less than ¼ inch for longleaf pine and ⅛ inch for all others. Top length should not exceed 14 inches with a supporting root system between 5 and 9 inches.

Seedlings should be planted to a depth slightly lower than the root collar, roots should be straight in the hole, and the planting hole closed tightly for best survival. Container-grown seedlings are also available. It is important to cover the root collar with dirt so moisture does not evaporate from the root medium.

Direct Seeding. An alternative to planting seedlings is spot or broadcast distribution of seed. Newly cutover sites can be regenerated for one-half to one-third the cost of planting provided the scattered seed falls on mineral soil so it can germinate and grow. Commercial seed companies and some timber companies sell ready-to-plant seed.

Follow these guidelines for successful direct seeding:

1. Use seed treated with a bird, mammal, and insect repellent.
2. Use stratified seed. Stratified seed has been stored for 45 to 60 days in moist conditions at 36 degrees to 40 degrees F which is necessary to prepare seed for germination.
3. Sow in early spring after an inch or more of rain.
4. Broadcast .5 to .8 pound of seed per acre by air or by hand-crank seeder.
5. Spot seed .25 to .3 pound of seed per acre in areas of desired spacing. At the same time, choose spots where chances of success are greatest. Three or four seed should be used per spot.

Seeded stands are more susceptible to drought and early competition pressure than are planted stands. A systematic inventory of seedling survival should be done at the end of the first and second growing seasons.

Conclusion

Artificial and natural methods of reforestation can be successfully used to reforest pines in North Carolina timberlands. Each method has advantages under certain situations. Landowners should select the best method for a specific tract in consultation with the County Extension Agent, County N.C. Division of Forest Resources representative, forestry consultant or industrial forester.

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